PORTFOLIO OF COMPOSITIONS

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ABSTRACT

A portfolio of acousmatic and mixed compositions for stereophonic and multichannel formats. Particular focus is given to acousmatic music's relationship with materials and features typically found in commercial dance genres.

The portfolio also includes development of Max/MSP tools for various functions, including spatialisation of sound, generation of material and also for performance, which is integral to one of the portfolio's later works.

To my father, for 29 years of unwavering support

Peter John Carpenter (1945 – 2011)

ACKNOWLEDGEMENTS

This portfolio would not have been possible without the sustained support of many people. I would like to thank my supervisor Jonty Harrison for his invaluable guidance. I would also like to thank the members of staff in the Department of Music at the University of Birmingham who have aided me over the years, particularly Scott Wilson and Kevin Busby.

Thank you to the BEAST community, past and present, for creating an incredible forum.

Thank you finally to my family for their support, and especially to Annie for a decade of encouragement and patience.

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MEDIA CONTENTS

Attached to this commentary are six media discs, the contents of which are as specified below.

Disc #01 (Data DVD)

Full quality versions of compositions (variously 44.1kHz, 24bit and 48kHz, 24bit). Also contains a portfolio player patch (written in Max/MSP).[1] (Please note that the portfolio player settings cannot be saved when playing from the DVD; if the patch detects that you are running from read-only media it will suggest you copy to a writable location and, if desired, it will automate the process.)

Disc #02-A (Audio CD – 44.1kHz, 16bit)

Track listing:

01: Flux (panoramic)

02: Mutable Musings

03: Pent-up [stereophonic reduction]

04: Halo

Disc #02-B (Audio CD – 44.1kHz, 16bit)

Track listing:

01: Sweet No.1: I – Grumpy

[1] Mac OS X only. Requires a minimum of Max/MSP Runtime version 6 to run (free to download from http://www.cycling74.com).

02: Sweet No.1: II – Crunchy

03: Sweet No.1: III – Pumpy

04: Tangle [stereophonic reduction]

05: Speckle [stereophonic archive recording]

Disc #03 (DVD Video)

Contains video recordings of Speckle performances (Norwich and Birmingham). Note that these are archive-quality only.

Disc #04 (Data CD)

Speckle Performance materials. Please note that to view the underlying code of the Max/MSP patch (which defaults to opening in 'Presentation mode'), unlock the patch and then click the tab marked 'Patcher' (located under 'Stop All Sounds!'). This will switch to Max/MSP's patching view and also resize the window as appropriate.

Disc #05 (Data CD)

Appendix files (Max/MSP code).

Includes: 14-bit random MIDI control; Orbisms; Sample accurate player.

LIST OF FIGURES

LIST OF DEFINITIONS AND ABBREVIATIONS

AB

Stereophonic recording technique, typically using two omnidirectional microphones in parallel with the capsules separated by around 40cm.

ATRAC = Adaptive Transform Acoustic Coding

The method of data compression used by the MiniDisc system.

DAW = Digital Audio Workstation

EQ = Equalisation

MS = Middle-Side

Middle-side stereophonic recording technique. Uses a cardioid (typically) and figure-of-8 microphone to create an encoded stereophonic image. Offers post-production flexibility with regard to stereo width.

ORTF = Office de Radiodiffusion Télévision Française

The ORTF stereophonic microphone system is a common recording technique that uses two cardioid microphones with the capsules placed 17cm apart, angled away from each other at 110°.

XY

Stereophonic recording technique that utilises two unidirectional microphones (typically cardioid) in a coincident configuration. Derives the stereo image from intensity (amplitude) differences.

INTRODUCTION

This commentary is a supporting document for the accompanying Portfolio of Musical Compositions and its software appendix. Rather than taking a generalised approach, it will examine key features found in each of the portfolio's compositions, discussing both technical and aesthetic issues. It will also look at software development and discuss some of the wider issues concerning electronic music and its future.

RESEARCH PROPOSAL

The original research proposal for the PhD was concerned with the examination of how acousmatic music could be integrated with more popular (yet perhaps still slightly esoteric) electronic music styles, or electronica (itself a vague umbrella term, not dissimilar to "electroacoustic"). The driving-force at the time was my interest and experience in the field, which has since waned somewhat, but I also became concerned by the issues presented when attempting to "shoehorn" one style into another, especially when aspects of the languages are incompatible, and the risk of failing to satisfy the musical objectives of either genre. Therefore, instead of explicitly integrating the styles I have attempted a more "natural" fusion of the worlds by allowing, or at least not suppressing, my affinity with the sonic and evolutionary characteristics of the different styles. When the materials do not coexist satisfactorily I have made a more conscious decision about where the stylistic focus should be, and there are elements in several of the works where materials/techniques explicitly reference electronica, although I would consider the portfolio on the whole to be one of acousmatic works.

COMPOSITIONAL PROCESS - AN OVERVIEW

Common threads run throughout the compositions presented in this portfolio, partly as a result of my aesthetic preferences, but also in relation to the software approaches and workflow method employed. The latter is an important consideration in any creative process that relies heavily on technology and is discussed in greater depth below.

COMPOSITIONAL DEVELOPMENT AND INFLUENCES

Electronic music in its most general sense has fascinated me since a young age. During my early childhood I was intrigued by the sounds produced by popular artists such as Vangelis and Jean Michel Jarre and this intrigue continued into my teenage years, attracting me to the electronic dance music of the 1990s. I began experimenting with music technology, initially with MIDI but later with audio materials, and was captivated by the ability to manipulate sound using a computer. At the age of 17 I began collaborating with a school friend (and subsequently with a local rapper) to form the group Anarchic Hardrive [sic], where we predominantly produced electronic dance music in the jungle and drum & bass styles. Knowing that I wanted to study music at degree level, I was attracted to the Department of Music at the University of Birmingham because of its reputation as an institute with a focus on electronic music. Electroacoustic music was at that time a field unknown to me (with the exception of Stockhausen's *Gesang der Jünglinge* (1956) which I was played whilst studying music at secondary school); however, the language and sonic characteristics were immediately familiar, not least due to their influence on the dance music I had been absorbing

during the preceding decade. After an initial, and unsuccessful, foray into acousmatic composition in the first year of my undergraduate studies, I began to experiment with methods of combining the techniques I had developed writing dance music with the gestural language and shaping of acousmatic music.

I found certain acousmatic composers immediately appealing; the harmonic language in Françoise Bayle's *Toupie dans le ciel* (from the album *Erosphère*, 1982) and use of materials in Bernard Parmegiani's *De Natura Sonorum* (1984) were both engaging, whilst the gestural languages of Francis Dhomont and Jonty Harrison were exciting and introduced me to a new way of thinking about the shape of music, and David Berezan's *Cyclo* (2003) combined gestural characteristics of the latter composers with a more familiar dynamically compressed and punchy production aesthetic of dance music.

The influence of music outside the Western art (specifically acousmatic) tradition is fundamental to compositions throughout the portfolio, as can be inferred from the text above. In addition to guiding the choices of materials, specific techniques (e.g. the chopping of sampled vocal material in *Halo*) are taken from artists such as Venetian Snares and Squarepusher, whilst development of ambient textures mimics techniques used by artists The Orb and Underworld (and therefore also Brian Eno). Influence from the glitch genre of music is also apparent, specifically Kid606's album *ps I Love You* (2000). Prior to these artists, whose music is relatively refined, an equally important influence is the music of Alec Empire and the mid-1990s output of the Digital Hardcore Recordings (DHR) label, although its effect on the compositions is generally less obvious.

CHOICE OF MATERIALS

Whilst my choice of materials is varied there are certain sonic qualities to which I am attracted. My general approach to materials could be considered as “clean”, which is to say that underpinning their creation there is a desire toward a detail-oriented production aesthetic, which involves honing the materials with various dynamic and equalisation tools. However, perhaps in contradiction to this, I find sounds exhibiting varying degrees of ‘noisy’ components to be attractive. For example, the primary source in the composition *Halo* is a 1930s vinyl record, partly chosen due to the medium’s inherent crackle.

Whilst my preference is to use newly recorded materials, there are moments when deliberately ‘bad’ recordings have been used. For example, one of the primary materials developed in *Mutable Musings* is a broken 4-string toy guitar that was recorded in 1997 when I was aged 15, using the standard (free) microphone provided with Creative Audio sound cards. Needless to say the quality is less than ideal, although I found this sonic naïvety interesting.

GESTURAL SHAPING AND "SONIC INERTIA"

A common thread in the discussion and analysis of acousmatic music concerns itself with how physical phenomena are identified in sound; for example, the terminology proposed by Smalley (1997) uses naturally occurring movement (e.g. flocking) to explain sonic evolution. I believe that this is a thread that permeates all music and feel

that the term inertia is particularly helpful when describing the interaction(s) between sounds. When approaching the composition of a gesture, for example, I will consider the implied physical properties of the sounds and how they can 'realistically' resolve. If the resolution is 'unrealistic', how then can the material be effectively prepared?

SPATIAL CONSIDERATIONS – STEREO OR OTHER?

There is no deliberate trajectory in the portfolio indicating a compositional development toward multichannel works. The first two were composed in stereo, the next in 8-channel, the following two in stereo and the final tape piece again in 8-channel. *Speckle* is the anomaly in that it is written for 4-channel tape, although this is a product of the desired relationship between the tape part and instrument (vibraphone), as will be discussed in that chapter that focuses on the work.

Whilst writing in 8-channels offers the composer potential for greater control over the shaping of sound in space, there remain significant issues concerning distribution of the music; octophonic sound, generally speaking, is the preserve and luxury of an academic environment. As academia remains a primary forum for the presentation of acousmatic music this is not necessarily an immediate issue; however, given that an underlying aim in this portfolio is to investigate how to bridge the gap between genres, it is a question that needs to be addressed. At the time of writing there are no commercially available multichannel formats apart from 5.1, which was primarily designed for motion picture presentation, rather than for music. Of course, any format can be either subverted or used in a manner sympathetic to its shortcomings, although both of these require compromise on the composer's behalf (not that the imposition of

technical restrictions is necessarily bad, as the resulting tension can be an effective creative aid).

SOFTWARE

It can be argued that the use of software in the composition of any computer-based music is fundamental in its influence and can substantially affect the rendering of the work. It goes without saying that the artistic and aesthetic aims are also of great importance but, critically, they are mediated by the tools available. As a consequence, this commentary occasionally discusses the use of software and related workflow employed during the composition of the pieces.

COMPOSITIONS: SUMMARY OF WORKS

The portfolio consists of seven compositions in various formats, as listed below.

- **Flux (panoramic)** Tape composition; stereo
- **Mutable Musings** Tape composition; stereo
- **Pent-up** Tape composition; 8-channel
- **Halo** Tape composition; stereo
- **Sweet No.1** Tape composition; stereo
- **Tangle** Tape composition; 8-channel
- **Speckle** Mixed composition for 4-channel tape, vibraphone and Mallet-Kat

All compositions are available on the media that accompanies this commentary. (See Media Contents for further information.)

The following seven chapters will detail the compositions individually and examine their key features.

FLUX (PANORAMIC)

Year of composition: 2005

Format: Stereo

Duration: 8:45

Acousmatic

SYNOPSIS

Flux (panoramic) was the first composition of the portfolio to be completed. It is distinct from the majority of other works (with the exception of *Tangle*) in that it uses a large variety of source material, mixing close-microphone recordings made from around my house in Birmingham with environmental scenes and manmade objects recorded near Ripon in Yorkshire. It also utilises synthesised material, borrowed from music that I was simultaneously composing in what could generally be described as the 'dance genre'.

STRUCTURE

The piece can be roughly divided into four sections, which are outlined as follows:

- **0:00 – 2:52**: Fluid evolution of key thematic ideas. Whilst this section can be further divided into two halves (the second 'bee' section being more static in comparison with the opening freneticism) the materials are clearly related and exhibit continuous development.
- **2:52 – 5:02**: Introduction of new harmonic and synthesised materials show clear

departure from opening, although there are frequent references to ideas heard in the previous section. The use of bass material is particularly significant in the structuring.

- **5:02 – 7:00**: Reflection on previous materials with a greater focus on 'drip' material. Typically, this point in a piece could be used to develop earlier materials, although in this case I consider 'reflection' to be a more appropriate term given the section's sparse nature.
- **7:00 – END**: It could be argued that the final minute is a continuation of the previous section, although its intended function is to make more explicit references to earlier material and hence close the piece.

Compositionally, one of the key thematic ideas that runs throughout the piece is the two pitch figure that emerges within the opening 8 seconds, resulting from the initial collisions of the logs/chains. These 'whistle' tones recur several times, for example at 3:13 following the introduction of new material at beginning of the second section and then again 5:54 and throughout the third 'reflective' section.
Another, perhaps slightly more subtle, theme is the drip motif heard for the first time at 1:12. Whilst it only recurs a few times in this form (for example at 5:03), the entire third section hooks on the development of the motif and its combination with the piece's other materials.

TECHNICAL EXECUTION

Flux (panoramic) was the only piece in the portfolio to be composed using the digital

audio workstation Samplitude (by Magix). Of all the software packages available for Windows XP (my platform of choice at the time), it seemed to offer the most features that were directly applicable to the composition of acousmatic music, such as the ability to add effects, auxiliary sends, EQ and dynamics to individual events in the mix window (as opposed to the cumbersome process of adding effects to a track and then rendering the desired section). The workflow was therefore extremely fluid, allowing the seamless integration of composition with the development and immediate adjustment of sound materials.

In addition to these workflow benefits, the software also had some interesting plugins, which could be exploited. The spectral tools were particularly useful and, at that time (2004), were not widely found in DAWs. Two examples of plugins that were extensively used in the piece's composition are: a powerful FFT equaliser with the ability to learn the frequency content of a given sound and apply it to another; a realtime convolver, primarily designed for reverberation (in a similar manner to Altiverb) but easily adapted to use any impulse. Whilst these tools are now ubiquitous, at the time they offered new possibilities in DAW-based sound design. A further interesting tool compared the spectral contents of sounds in the library and suggested which materials might be compatible; unsurprisingly this was not always effective, although it did provide occasional appropriate matches.

The equipment used for recording the acoustic sources was a Sony ECM-MS957 stereo (MS) microphone and Sony MZ-N10 portable MiniDisc recorder. Whilst this recording set-up was not ideal, every effort was made with microphone placement to capture the

sounds as clearly as possible, thus reducing issues of the noise floor, and also the MiniDisc ATRAC compression artefacts that increase in relative audibility with quieter sounds.

MATERIALS AND MANIPULATIONS

Working in the electroacoustic medium offers the composer the possibility of working with an array of disparate materials to create a coherent piece. Unlike most of the portfolio's other works, which are deliberately centred around one or two sources, this is one of the key principles behind *Flux (panoramic)*.

As mentioned in the synopsis above, a considerable range of different material is used. The key sounds are outlined below.

- **Wooden logs suspended on chains**. As was typically found in a children's playground, although less frequently now due to health and safety concerns. Test recordings were made during the day with final recordings made at 2am to avoid ambient noise. (Recorded at a school's playground during the summer vacation period).
- **Bumble Bee**. A difficult source to capture due to the necessary proximity. Made during the day whilst a tractor was operating in the adjacent field (discussed further below).
- **Tap (drip)**. Recorded in a domestic sink.
- **Overtone singing and whistling in a resonant acoustic**. Recorded in the Temple of Piety at Studley Royal Water Gardens in North Yorkshire. Thanks to Ben Palmer for the overtone singing and Andrew Huntriss for whistling.

- **Gittern**. Pitched material – subjected to granular processing.
- **Cork from Port bottle**. Studio recording.
- **Synthesised bass tones**. A variety of synthesised bass tones, subjected to basic EQ to accentuate certain frequencies.

The use of bass material throughout the piece (and also the portfolio) is significant, as it often directly references non-acousmatic music that I was composing simultaneously. The re-appropriation (or re-contextualisation) of material is something I have always found interesting, since it builds upon a relationship the composer already has with the sound. For example, the slowly evolving bass phrase that appears at 5:34 is taken directly from a piece I composed 3 years previously and consequently has, for me at least, its own references and significance outside of the work. Whilst any extra-musical association of this type is known only to the composer, it has the potential to act as an abstract guide in a work's composition. For example, a meaningful sound could become a point of musical emphasis and hence gain structural importance.

The bumble bee material (mentioned above and first heard at 1:05) presented a challenge due to a loud tractor in the field adjacent to where the recording was made. The bee itself was captured at a distance of approximately 30cm, which resulted in a good stereo image (the bee's motion created convincing sonic trajectories). Therefore, not wanting to discard the recording, I used Samplitude's FFT equaliser to perform a spectral capture of the bee which was then used to apply a filter to the entire recording, effectively tuning the extraneous noise to the bee's pitch. The resulting sound was

musically restricted to a drone, but it still had greater potential than the unprocessed version.

MUTABLE MUSINGS

Year of composition: 2006

Format: Stereo

Duration: 12:40

Acousmatic

SYNOPSIS

Mutable Musings, the second stereophonic composition in the portfolio, is probably the least successful tape piece in that it lacks the structural coherence of the other works. I now find that the use of materials is not always compelling, even though the sounds' overall polish is quite high, with materials being spectrally rich and balanced. Gestures lack the control and pacing that is present in the other works, often appearing without sufficient preparation, and the erratic quality of some of the textures means that they do not function correctly.

This piece will not be discussed in great detail as any unusual techniques employed were not used to any significant extent in the remainder of the portfolio as I considered them less than completely successful.

SOFTWARE & WORKFLOW

This was the first piece to be composed using the DAW Nuendo 3 (by Steinberg), which was ultimately the software most extensively used over the duration of the

portfolio's composition (in both versions 3 and 4).

The compositional workflow in this instance was fragmented, which probably contributed to some of the coherence issues mentioned above. It was partly composed at home using the PC version of Nuendo and partly in the Electroacoustic Studios at University of Birmingham, using the Mac version of the software. There were some compatibility issues between the two platforms, mainly regarding the use of external plugins, which meant that compromise was required concerning how, for example, the reverberation effects were managed.

Processing in the piece extensively utilises the Destroy FX set of plugins (freely available online) which, whilst producing some interesting sounds, result in materials having a similar sonic colouring. This in itself is not a problem (and is somewhat inevitable), but if one restricts their use of plugins too heavily in a given composition, the piece can exhibit an identifiable sonic fingerprint.

MATERIALS

As in *Flux (panoramic)*, a broad selection of material is used, although the piece emphasises a few key sounds with others taking a more subservient role; *Flux (panoramic)*, on the other hand, distributes the thematic importance to different sounds more evenly.

The key sounds in *Mutable Musings* are:

- **Bicycle**. Various sounds produced by a push-bike, such as the mechanical movement of the chains on cogs and also the derailleur action. Further sounds were made by 'playing' the spokes with scissors and also by placing paper and

card onto the spinning wheel.

- **4-string child's toy guitar (broken)**. Recorded using a cheap microphone (discussed in greater detail below).
- **Vocal sounds (various)**. Primarily vocal percussion (often referred to as 'beatboxing').
- **Jar of dipping-sauce**. Sounds made as spoon contacts the sauce and also the glass jar.

As discussed in previous chapters, the use of materials that hold extra-musical meaning is important. An example of this is the recording of a broken guitar used extensively throughout *Mutable Musings*. This particular recording was made using the generic microphone provided with Creative Audio sound cards. The relatively poor sound quality from this microphone promotes a certain approach to treatment of the materials in terms of processing. Perhaps unimaginatively, the sound was subjected to a variety of distortion and saturation effects – whilst masking some of the recording's issues, effects of this nature can also increase the level of harmonics and hence enhance the timbral colouring of the sound.

AESTHETIC CONCERNS

Mutable Musings was the first piece explicitly to reference the dance genres referred to in the PhD proposal. Whilst the overt use of distortion effects can also be attributed to a sound world generally found outside acousmatic music, there are some specific instances in the piece where rhythmic and sonic elements combine in such a way that

the reference is made clear to the listener. One such example is between 4:20 and 4:30, where one of the sounds assumes the role typical of a kick-drum in a dance pattern, briefly locking into metered rhythms, although quickly slowing and eventually dissipating. Another is at 8:59 – 9:05, where a similar technique leads the listener into the final section of the piece.

SUMMARY

Whilst I have spent some of the previous chapter criticising this work, I feel that there are some effective moments, particularly the slower sections where the sounds interweave to create evolving textures. The passage leading towards the end, following the energetic section at around 9:00, uses the guitar recording processed with a different technique (combining distortion and reverberation) that results in a sound which could be mistaken as a child's voice. The character of the piece holds a certain naïvety, making this seem like an appropriate ending.

PENT-UP

Year of composition: 2007

Format: 8-channel

Duration: 8:14

Acousmatic

BACKGROUND

Pent-up was initially conceived as a 10-channel work, employing an 8-channel ring of tracks/loudspeakers plus a stereo pair of tracks that could ultimately be diffused. This idea remained through the early stages of the piece's composition but, upon further consideration, I felt that it restricted the piece entirely to concert presentation and that it was more pragmatic to reduce the channels to conform to a normal 8-channel ring.[2] Also, the preliminary development of materials did not provide sufficient musical justification for the additional stereo voice.

RECORDING

As my first foray into multi-channel composition (i.e. more than 2 channels), *Pent-up* offered an opportunity to experiment with the capturing of a source beyond the standard stereophonic recording techniques (e.g. ORTF, XY, AB, MS). The obvious solution was to design the layout of the microphones to mimic the layout of the

[2] Whilst there is no definition of the 8-channel array to the degree that can be found in Dolby's cinematic surround formats, there are two widely accepted standards: the "double-diamond" and the array made from 4 stereo pairs, distributed from in front of the listener to behind. There is a diagrammatic representation of both layouts in the appendix.

loudspeakers. Whilst there are potential phase-related issues inherent in this approach, it seemed worthwhile to pursue, and ultimately provided all of the wind-chime recordings for the piece.

The decision to use a hyper-cardioid polar pattern was based on the logic that off-axis frequency colouring would increase timbral variation between sounds captured on the different microphones, consequently enhancing the sense of movement. The same logic was applied to the front-to-back descending slant, presuming that sound radiating from the ends of the wind chimes would probably be different from that at the sides, given the complex vibrations of a cylindrical object. If the microphones were placed on the same vertical plane with respect to the chimes (i.e. each pointing toward the middle of the tubes), these differences would not be accentuated.

The final recording setup was as follows:

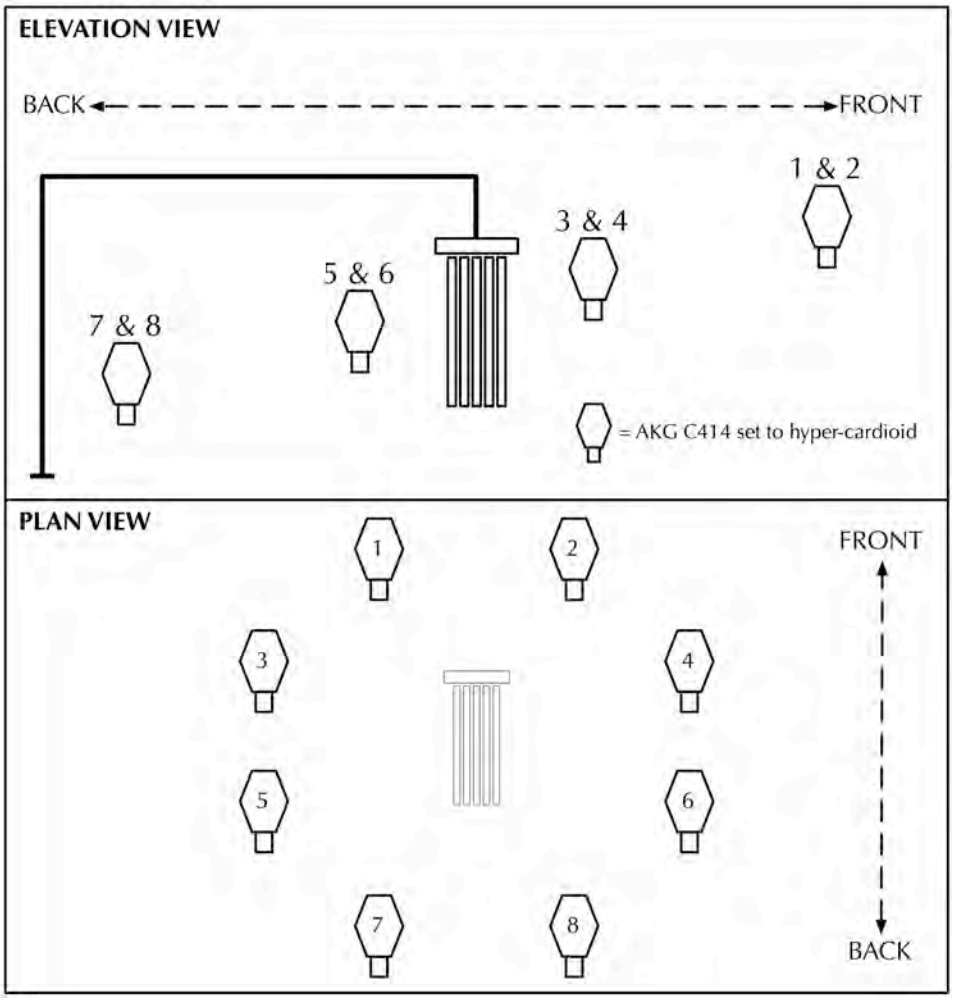


Figure 1 – *Pent-up* recording configuration

The recording format used was 96kHz, 24bit, which unfortunately led to some issues on the final recording as the computer's hard drive was not fast enough (5400RPM) to write the data, resulting in audible clicks from insufficient buffering. As the computer was in a neighbouring room with no monitoring in place, I did not notice these issues until a substantial duration of recording had been captured and it was unfortunately impractical to re-record everything; instead, a large amount of editing was undertaken

to remove the problematic sections.

There were some further compromises regarding preamplifiers – the first four channels were pre-amplified on the soundcard (MOTU Traveler), whilst channels 5-8 used an RME QuadMic preamplifier. This made it difficult to match the level of amplification from the two devices and also would have resulted in variation in tonal colouring, although not to an extent that was problematic and, if anything, this would further enhance differences between the eight microphones.

MATERIALS AND COMPOSITION

Pent-up uses three sources:

- **Pentatonic wind-chimes**, roughly tuned as: C6, D6, F6, G6, Bb6. In combination they produce a variety of sum & difference tones, a dominant difference tone being Eb4.[3] Recorded in 8-channels (as discussed above).
- **Frog guiro**. Performed using a variety of techniques, including spinning the frog axially around the beater positioned in its mouth. Recorded in stereo (Neumann KM184s in ORTF array).
- **Grill frame**, suspended in a vice to reduce dampening of the resonances. Recorded using two piezoelectric transducers to produce a 2-channel recording. This type of contact recording accentuates resonances that would not otherwise be audible.

Broadly there are two techniques used to process and spatialise the sounds:

[3] Pitch names given using scientific pitch notation, where C4 = middle C.

Drone-type (chordal) materials are subjected to appropriate stereophonic effects and then spatialised into 8 channels. For example, a stereo source could be copied four times with each iteration passed into the same type of process but with slightly different parameters in each instance. The resulting 8 channels (2x4) are then jumbled to remove the stereo pairing and either remain static or are subjected to movement appropriate to the nature of the sound. An example of this approach can be heard in the drone introduced at 2:26.

Articulative materials are distributed using an automated process written in Max/MSP, effectively delivering each sonic event from a different position in the 8-channel ring. An example of this approach can be heard at 3:55, although the distribution engine used in this instance is less sophisticated than in later versions of the patch (e.g. the one used in *Tangle*), in that the individual events pan, rather than remain fixed for their duration. Overall, this second process generates a large quantity of material that requires further editing.

Compositionally, much of the source material was left untouched, with an emphasis in the musical discourse being the tension between pure (unprocessed) sounds and heavily manipulated materials. In hindsight, more should have been done with the raw source materials to iron-out imperfections in the sounds. Both the wind chimes and the frog guiro exhibit abrasive attacks, which would have benefited from smoothing through the use of EQ and compression.

With regard to the initial PhD proposal, *Pent-up* was the first composition in the portfolio explicitly to present material in a metre. Whilst, as discussed in the previous

chapter, *Mutable Musings* made fleeting references to this possibility, the emphasis on metre from 4:28 is undeniable and repetition of the first section of the 8-bar phrase beginning at 4:41 is an obvious reference to the electronica genre.

One significant problem encountered during the composition of the piece was the inconsistent balancing of the subwoofer in the studio. It took some time to calibrate the subwoofer effectively, which meant that there were several occasions when large quantities of the piece's processed material had to be adjusted to compensate for the changes in low frequency intensity. This was never an entirely satisfactory process and there are still sections in the piece where the low frequencies are not correctly balanced. The problem is compounded when creating the stereo reduction (see below for further discussion regarding the need for this) as low frequency phase interference between channels makes the range uneven when they are summed.

MIXING

Given that the materials used were neither exclusively stereo nor 8-channel, the mixing environment had to offer enough flexibility to accommodate these differences. The piece was composed using Steinberg's Nuendo software which, whilst offering greater multichannel control than other DAWs at the time, restricted the output to standard cinematic formats. A creative use of the software's routing capabilities was therefore necessary to achieve the desired result, using a mixture of "child-bussing" and channel groups to allow stereo sound-files to address the 4 stereo pairs of the 8-channel ring

discretely.[4] The final mixing window contained 10 tracks for mixing 8-channel files and then a folder for each of the pairs (i.e. 1+2, 3+4 etc.) containing a further 4 tracks. In addition, there were a few channels that allowed use of the multichannel panner built into Nuendo for the automated distribution of both mono and stereo sources, although these were not ultimately used as all distribution across the array was achieved either through pre-processing or creative mixing of the stereo pairs.

STEREO REDUCTIONS

For composers working in multichannel formats it has become standard practice to produce a stereo version (or stereo reduction) of their pieces. This is often viewed as a necessary evil, given that it can significantly compromise the spatial element of a piece; however, if one wants to disseminate one's work it is a requirement. A frequent discussion amongst acousmatic composers concerns the authenticity of such reductions and answers will vary depending on an individual composer's opinion about the importance of space in their work. Interestingly, this question is gaining further relevance as composers write for increasing numbers of channels, and it could be argued (perhaps tenuously) that there is a parallel in the film industry with the recent explosion of multiple-format movie releases. For example, Peter Jackson's *The Hobbit* (released December 2012) was available in 2D, 3D, 3D HFR (high frame rate) and IMAX; the question then arises about what constitutes the essence of the work and whether, in the case of *The Hobbit*, there is a version the film's director would prefer

[4] In Steinberg's Nuendo, "child bussing" is a feature that allows the user to address specific outputs within a surround bus. For example, if the surround bus were 8-channel, a stereo child bus could address the two frontal loudspeakers as a separate pair.

the public to see.

Please see the appendix for a technical discussion of stereo reductions in my pieces.

HALO

Year of composition: 2008

Format: Stereo

Duration: 12:36

Acousmatic

SYNOPSIS

Halo differs from the other works in the portfolio due to its use of material. Other compositions take a general approach to sound that adheres to Pierre Schaeffer's theory of reduced listening or *écoute réduite* (a good example being *Crunchy* where the sound's source is contextually unimportant throughout). Whilst the primary focus in *Halo* is its musical narrative, the vocal, piano and vinyl sound materials are not disguised and in fact are intended to invoke a degree of nostalgia in the listener due to their extra-musical associations with the recording medium.

The title is derived from an audible artefact produced as part of the spectral processing effect used on the vinyl recordings.

MATERIALS

The piece's materials vary, but at its core is a record player. There are mechanical noises and other associated sounds, although a substantial amount of material is from a 1938 recording of Duke Ellington's *Solitude*, sung by Adelaide Hall with organ

accompaniment by Fela Sowande. (In the opening section the singer is in fact accompanied by piano, which is not credited, although is presumably also Fela Sowande.) The record (along with a number of other 78rpm discs) was purchased by my great-aunts, who lived together in Bristol from the 1920s through until the final aunt's death in the 1980s. Having this personal extra-musical association is certainly interesting for me and, whilst it did not actively affect the piece's composition, was something that I was aware of throughout the process.

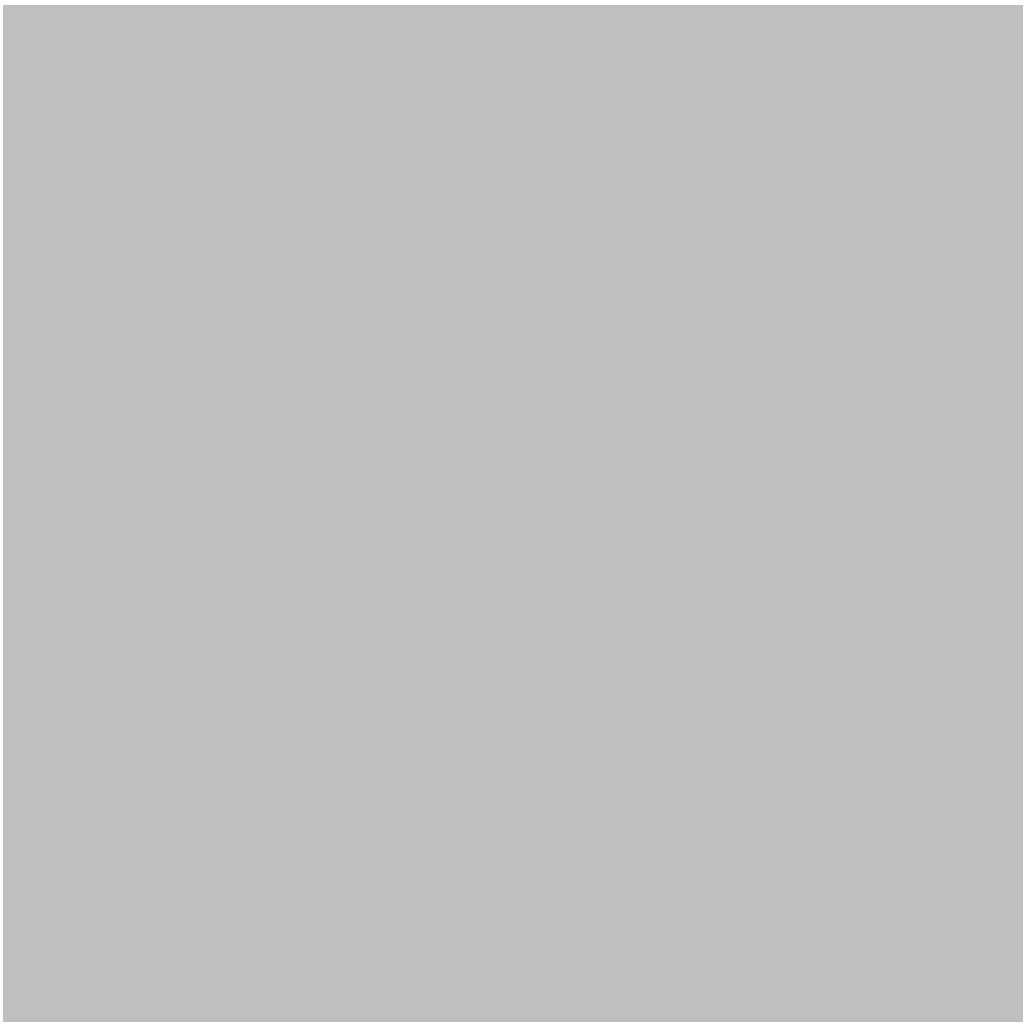


Figure 2 – Photograph of the record that was sampled for *Halo*

Other materials include:

- **Synthesis** (various types).
- **The sea**, recorded on the Dingle Peninsula in Ireland.
- **Contact microphones on a bed cover**, recorded in Xàbia, Spain.

Whilst the location of the final source has no audible bearing on its sound, it is compositionally interesting (again on a personal level) that a diverse selection of materials can be interwoven to produce a coherent sound world. As previously discussed with regard to *Flux (panoramic)*, this has the potential to offer the composer an increased emotional engagement with their work although, it should be noted, does not affect the listener's understanding of, or engagement with, the music.

PROCESSING EFFECTS

When using materials with a significantly reduced bandwidth, especially if capturing from a medium such as the 78rpm disc, there is a constant battle with the uneven frequency response and it is therefore necessary to suppress or accentuate parts of the spectrum to balance the sound. Also, even though the record player used in this instance to make the recordings was capable of 78rpm playback, the correct type of stylus was not used, thus adding to the high-frequency noise content. Another key feature of any vinyl recording, but especially prevalent on 78rpm discs, is crackle. It is impossible to escape this bi-product of the medium and, in the case of *Halo*, it was useful in providing high-frequency content that was otherwise missing from the recording.

In a vain attempt to 'clean-up' the vinyl recordings I subjected all of them to a noise-reduction process using Waves's X-Noise plugin effect. Interestingly, I discovered that by increasing the 'Release' parameter in the dynamics section to an abnormally high value, the captured spectral profile would continue to sound ethereally after any dynamic attack, creating what could be described as a halo around each of the sounds and hence the title of the composition. An example of this process in action can be heard at 7:09, where the pitch in the attack continues but is integrated with the shape of the vinyl noise that follows. A similar effect could be achieved with convolution but the nature of the Waves plugin was such that it was possible to 'play' the effect during the recording process, moving the needle around the disc to capture various chords and then applying them to different parts of the song. As such, this is the only instance in the portfolio where the processing techniques were entwined with the act of recording – normally they occurred separately. However, subjecting material with uneven frequency distribution to any FFT-based effect can exacerbate this unevenness. To combat this issue, extensive filtering and multi-band compression were applied to much of the material, a particular example being in the final two minutes of the piece where some of the voice's formants were unnaturally loud.

COMPOSITIONAL STRATEGIES

Halo was composed over about 10 months, which made it a difficult piece to structure and also a difficult piece to assess objectively (as far as is ever possible for the composer).

There were a few musical devices used in the piece that exploited the medium of vinyl, an example being the loop from 3:04, designed to mimic the sound of a closed record groove (or to use Pierre Schaeffer's term, *sillon fermé*). However, after several iterations, the listener will perceive that the groove is constructed from two loops that gradually move out of synchronisation.

The piece, in a vague sense, is framed by the idea of the listener being immersed within the record: the opening dive is represented by the descent of the vinyl crackle into an increasingly abstracted sound world, whilst at the final surfacing we emerge to an unprocessed sample from the end of the disc.

SWEET NO.1

Year of composition: 2009

Format: Stereo

Duration: 18:30

Acousmatic

SYNOPSIS

Sweet No.1 is a suite of acousmatic compositions in 3 movements:

I. *Grumpy*

II. *Crunchy*

III. *Pumpy*

The decision to write a suite was made following some initial compositional sketches of what would eventually become the 3rd movement of *Sweet No.1*. I wanted to compose a more substantial work, given that a number of other pieces in the portfolio had individual durations of less than 10 minutes; however, the materials I had been developing were such that it was difficult to envisage how they would contribute to a coherent, single piece.

Having begun the composition with the 3rd movement I quickly moved to working on the 2nd, as it was yielding better results. The nature of this movement was considerably more subdued, due to its slow harmonic rhythm (and despite the skittish quality of the

source material) and it therefore seemed that it could function as a slow movement. Given the frenetic nature of the 3rd movement sketches I decided to follow, roughly, the fast-slow-fast movement form of many 'classical' works, although mapping this idea to overall density (or intensity) as opposed to the more traditional tempo relationships. With this in mind, a core concern then became how to integrate the movements musically.

THE *IDÉE FIXE*

As the 3 movements were to be presented as a coherent work, I felt it important that a running theme or *idée fixe* was present. An early sketch was the final "techno" section of the last movement and it seemed that an effective unifying device could be a pre-echo of this material. However, a direct quote would be difficult to integrate and would also reduce the element of surprise encountered in the final 2 minutes. Instead the material is presented, framed by the "thumping" of club music that is frequently heard propagating from passing cars (at least in Birmingham, UK). A simple Doppler effect was applied to emulate this phenomena, although if one were being scientific it should be argued that due to the low-frequency characteristics of the sound-source, the Doppler effect would not be so apparent; however, the objective was to create a musical device, not to be realistic.[5]

This *idée fixe* is not made explicit in the programme note, although it is usually presented during moments of relative inactivity to accentuate its function as a thematic

[5] The Doppler effect emulates the naturally-occuring sound phenomenon whereby the perceived pitch of a sound-source approaching and receding from a static observer increases and decreases respectively.

device. It could be argued that it is too subtle to fulfil this function effectively and there is also a problem with playback on systems incapable of reproducing low frequencies.

I. GRUMPY

Grumpy, the first of the movements, was in fact the final of the suite to be composed and is effectively an introduction to the other two, rather than a substantial movement in its own right.

The material is a precursor to that found in the latter movements, although in terms of the listener's perception the emphasis would appear to be on the final movement's materials as the pitched element that is core to the second movement is not present.

A key priority of the movement is that it emphasises the relative serenity of the second and, as such, the intensity builds to an almost unbearable level during the final 5 seconds.

II. CRUNCHY

Crunchy was the first piece from the suite to be completed, following a few sketches for *Pumpy* (as mentioned in the introduction). It can also be presented as a standalone movement, unlike the other two which are not as effective in isolation because of their structures. The majority of the movement's sonic materials are derived from a small plastic tray (such as the type in which supermarket herbs are contained), with the primary method of processing being extremely short band-passed (harmonic) delays with approximately 90% of the sound being fed-back into the process.

The explicit use of the echo effect during the first 15 seconds of the movement was

conceived as a sonic reference to the ambient dub genre and specifically the electronic music group The Orb. This particular reference also drives the role of bass in the piece (e.g. the descending tone at 0:32) whilst the decorative high-frequency materials (heard at 4:07) reference The Orb's album *The Orb's Adventures Beyond The Ultraworld* (1991), specifically 3:09 in *Super Nova At The End of The Universe* (disc 1, tr.3).

III. PUMPY

The final movement's title holds two meanings, referring simultaneously to both a bike-pump (one of the primary sources) and also the compression-effect artefacts used thematically throughout the movement.

Compression has transcended its original function, which was to control dynamic range (e.g. of high-energy transients in vocal recordings) and afford a mixing-engineer greater control when balancing multiple tracks. The so-called 'loudness war' has forced the dynamic range in some popular musics to decrease to an extent where compression artefacts have become audible, whereas in the past a mastering-engineer would have been at pains to disguise these sounds. Therefore, in a comparable way to the change in the use of the pitch correction effect (commonly known as Auto-Tune after Antares's audio processor) – as famously demonstrated in Cher's track *Believe* from the album *Believe* (Cher 1998, tr.1) – compression has become a musically explicit effect rather than one operating transparently in the background. An example of this in current popular music (2012) is David Guetta's track *Titanium* from the album *Nothing but the Beat* (Guetta 2011, tr.12), specifically at 1:16.

Subversion of an effect beyond its primary intended application is a practice commonly found amongst acousmatic composers and is something I find interesting. Compression is hence used as a thematic device throughout this movement of the suite, as outlined below:

The final section of the movement emulates the compression artefact *pumping* by using a compressor with a side-chain function to alter the dynamics of the synthesised chord. The side-chain takes as its input the bass frequencies (effectively the pulse) from the rhythm part, whilst the compressor's release duration roughly matches that of a crotchet (if we were to imagine the rhythm being in 4/4 time). By contrast, the section from 2:55 focuses on a more abstract representation of the compression artefact *breathing*, where the applied dynamics battle against the sounds' natural shapes.

SUMMARY

Of all the pieces in the portfolio, this presented the greatest musical risk in its attempt to explicitly combine the worlds of acousmatic and dance music. I found that its reception was mixed, although generally positive.

TANGLE

Year of composition: 2010

Format: 8-channel

Duration: 9'50

Acousmatic

SYNOPSIS

The piece's title is derived directly from the origin of the materials, insofar as they are a blend of either sounds originally intended for, but not included in, other works or are materials that exist in earlier compositions but are re-contextualised. This idea is an extension of the one presented in other compositions' discussions, concerning the use of materials extracted from my other sphere of electronic music.

MATERIALS

Part of the desire to re-contextualise the materials was driven by an interest to see how they behaved when expanded spatially from two to eight channels, especially those found in *Flux (panoramic)* and *Halo*. Besides this spatial processing and some pitch variation, there were few manipulations applied to the materials, with the change in contextual presentation of the sounds being fundamental.

The other primary materials for the piece came from an unfinished work that was started alongside *Flux (panoramic)*. Structurally it was never entirely satisfactory, hence its abandonment, but it did contain some interesting sounds, not least the recording of a

wine glass being scraped with a sharp knife. These pitched scraping sounds are present throughout Tangle and are often subjected to elongation using a phase vocoder, which effectively allowed spectral scrubbing through the file (e.g. 0:41). They are also presented in what could be described as 'wonky loop', which is a core theme in the composition and is audible clearly for the first time at around 2:04, although only fleetingly.

COMPOSITION & RE-COMPOSITION

Structurally, the distribution of frequency range across the piece is important – the first section to be completed was from around 5:05, just prior to the entry of the synthesised bass. My desire was for this to be an arresting moment and so I avoided substantial use of low frequency material up to this point. In an attempt to accentuate the entry still further, the section from 3:22 is deliberately sparse, as is the transition from the dense descent beginning at 5:05.

Tangle was the first work in the portfolio to receive a substantial modification following the premiere performance. Modifications applied previously to the other works were primarily to compensate for balance and EQ issues and often followed the rehearsal of the piece in a real acoustic (as opposed to a controlled studio environment). In the case of *Tangle*, the final few seconds of the piece did not transmit as I had hoped when diffused in concert, the original idea having been to provide an intentionally lacklustre ending to contrast some of the earlier, more intense moments. In an attempt to create this ending I chose a sound with energy concentrated in the upper frequencies;

however, in practice this sound was lost in the acoustic and had the effect of the piece appearing to stop abruptly, rather than end convincingly. The adjusted ending is still understated but now consists of a short flourish that is similar to that found at the end of *Pent-up*.

SUMMARY

As the final acousmatic composition in the portfolio I deem *Tangle* to represent a technical culmination of my explorations and experiences in the earlier works. The spatialisation is generally more convincing, as is the gestural control and the overall balance. Despite containing material that is common to other works in the portfolio, it has an individual sonic character.

SPECKLE

(for Simon Limbrick)

Year of composition: 2011

For vibraphone, MalletKAT and 4-channel interactive tape

Duration: c10:00 (open-form)

SYNOPSIS

Speckle was commissioned by percussionist Simon Limbrick and is the only work in the portfolio for tape and instrument. Live performance, in some guise, was an area alluded to in the proposal for the PhD and I felt it an important element to include, as it offered an opportunity to develop my Max/MSP skills in a new, practical direction. The commission was for a piece incorporating vibraphone and tape, to complement a concert programme of other works for tuned percussion instruments and electronics. The decision to write for 4-channel tape was based on the desire to present both a conventional tape part (as far as such an idea exists) and a sonic extension of the vibraphone itself by way of loudspeakers positioned close to the instrument's resonators.

SONIC MATERIALS

At the beginning of the project Simon offered an extensive library of vibraphone samples that he had previously recorded; however, after some preliminary experiments I discovered that the purity of the tones produced by the vibraphone (following the

initial attack) were failing to yield materials that I found engaging. Instead, therefore, I focussed on materials that conceptually extend the sonic potential of the instrument, imagining another layer derived from sounds produced by the resonators. To achieve these sounds (and rather than dismantle the instrument) I turned again to wind chimes as a substitute, although I used a different set from that which forms the materials in *Pent-up*. Apart from striking the chimes I also treated them as pitched tubes, blowing across the top of the pipes. Unfortunately the resulting sounds lacked enough of the necessary pitched component, so the chimes were ultimately substituted with slides from a tuba.

The majority of sounds in the piece have their origins in these two sources with the exception of the synthesised bass that appears in the last 2 minutes.

MAX/MSP PATCH

The software for *Speckle* was built entirely in Max/MSP. It exists as a patch (rather than an application) but is designed in such a way that it is fully usable in the Max/MSP Runtime environment – something that is crucial for the dissemination of one's work (i.e. it does not rely on paid software).

An issue with designing for the Max/MSP Runtime environment is the inability to store user settings conveniently (e.g. hardware input and output numbers, output balances appropriate to the loudspeaker system, etc.) – the 'Preset' object is not sufficiently transparent in this respect. The patch therefore employs my *Prefs.maxpat* abstraction, allowing the storage and retrieval of a performer's settings without the need to save the patch itself. In the unfortunate case of a software crash this means that all settings

would be restored when the patch is reopened, allowing the piece to be resumed quickly. Further discussion of *Prefs.maxpat* can be found in the chapter on Max/MSP code.

In its most basic form the *Speckle* software is a sound-file player capable of 2-channel and 4-channel playback and, in the case of stereo files, has the ability to assign output to one of two loudspeaker pairs: close (adjacent to the vibraphone) and wide (the primary destination for conventional tape materials). The software was also designed with flexibility in mind and a wish to create a platform that could be used for a variety of different works. As such, the majority of the performance data (e.g. key-mappings, sample information and associated triggering data) is stored in text files, separate from the patch. By avoiding the practice of hard-coding this data, the piece's behaviour can be altered by the relatively simple act of modifying the text files (which is particularly advantageous when working remotely from the performer as updated text files can be emailed easily). Also, the modular nature of the patch means, for example, that the portion of the code which handles the MIDI input data could be swapped with a different portion of code to handle OSC input data, without affecting the remainder of the patch.

Text files and their generation/manipulation

Due to the convoluted nature of the text files that are read by the 'Coll' objects, the majority of editing was achieved via a spreadsheet programme (e.g. Microsoft Excel). An example of one of these spreadsheets can be found in the appendix.

There is also a sub-patch, *instruction_builder*, which exists as a compositional tool to

generate and manipulate the raw text data via a graphical user interface. For example, if a particular trigger is too loud it can be quickly adjusted via this patch without the need to find the relevant line in the text file. From early in the project I considered it important to separate the practice of coding from the practice of composition, as the former can distract me from the latter; interfacing with lines of raw text code does not, in my experience, enable a creative atmosphere if one is used to a compositional process involving immediate sonic feedback.

User interface and practical concerns

There are a number of user interface components to the patch, the majority of which are intended primarily for rehearsal use:

- MalletKAT_indicator: Indicates which keys are currently active.
- METERS: Level metering for the Tape and ExtVib signals.
- poly:_playing_grid: Shows the status for each of the 30 file-players. The number is the sample currently active and the number-box colour indicates whether the file is playing normally (green) or in the process of fading (orange). The sample name is also displayed to the right of the box and if the text is red it indicates that the sample is currently looping.
- dummyKAT: A MalletKAT mock-up for testing purposes.

In addition to the above there is a standalone window that shows only the current scene number. This is arguably the most useful for performance and can therefore be resized as required.

Real-time stereo reduction

It can be assumed that for rehearsal purposes most people will not have access to a 4-channel playback system, so the patch includes a simple switch to allow the user to use either the full 4-channel or a collapsed 2-channel system.

COMPOSITION AND SCORING

For practical reasons related to the development of the software, the piece is divided into 5 scenes with each scene specifying different MalletKAT sample mappings and behaviours. The score shows each scene on a single page and presents the information graphically, along with text-based descriptions and notated cells indicating how the scene should unfold.

The broad structure of the piece defines a typical transitional arc from a known sonic entity (the vibraphone), via an increasingly abstracted version of the instrument, and finally back to the original instrument, albeit viewed at a different sonic angle. The purpose of the opening scene is therefore to introduce the two timbres of the vibraphone and chimes, presenting them side-by-side to make a believable sounding instrument. For this to work, the balance between the vibraphone and close loudspeakers requires careful matching – ideally the vibraphone should not be amplified. The sounds of the instrument then become increasingly impossible (via detuning and the introduction of rapid motivic fragments), up to the introduction of the blown pipes in scene 4. The vibraphone then transforms back to its original sound, this

time bowed, whilst the balance shifts towards the tape as the primary part.

LONGEVITY

Whilst I shall not hypothesise as to a solution for the problem, it is important to consider, with any composition that uses bespoke software, the way in which the piece could be rendered in the future. Unfortunately, it is impossible to guess how compositions integrating acoustic instruments with electronics will be performed in hundreds of years, given the rapid rate of technological development.

In the case of Speckle, the integrated use of text files might provide an easier way to understand the structuring of the piece's materials, although in their current undocumented state a certain amount of guessing would be necessary. Another option would be to document the entire technical construction of the piece, for example detailing each 'page' in terms of the sample mappings and their behaviours. Assuming that the audio materials were available, the player patch could then be rebuilt in another application.

CRITICAL EVALUATION

Speckle is certainly the most experimental piece in the portfolio, insofar as the compositional techniques differ substantially from the other works; it is also the most naïve work, due to the relative infancy of these techniques.

It lacks the controlled pacing of the other compositions and the attention to detail concerning the development of materials and their integration within the broader sound world. (An example of this is the introduction of the individually triggered 'Pipe attacks'

in scene 4, which lacks the necessary sonic preparation and hence sounds musically arbitrary.) I do not consider this to be a failing of the software which, whilst necessarily restricting the compositional possibilities, is sufficiently sophisticated to allow shaping of the materials. Instead, a greater range of materials needs to be engineered to make the sound world appear coherent.

MAX/MSP CODE

INTRODUCTION

An important aspect of my development as an electroacoustic composer has been the formation of a core skill-set in the audio programming language Max/MSP, released by Cycling 74. The code that I have developed is, on the whole, designed for personal use, focussing on the practicalities of what I wanted to achieve in terms of processing. This results in code which is not always visually clear, although I have attempted in most cases to present it in such a way that the underlying logic is apparent. In this section I will discuss the main patches that have been used compositionally. (Please note that there has already been discussion concerning some aspects of my Max/MSP programming in the previous chapter on the composition *Speckle*.)

CODING PHILOSOPHY

Operability

When building patches or applications for use by others, I strongly believe that usability (in support of functionality) is of primary importance. On many occasions I have experienced software that is not at all intuitive which, in a concert situation, is unacceptable. Since the release of Max/MSP 5 in 2008, the ability to build a patch and then produce a semi-discrete graphical user interface (GUI) using the presentation view has offered programmers the ability to code in a clear manner, unhindered by concerns of end-user operability.

Prefs.maxpat

One example of this concern with operability is my *Prefs.maxpat* patch. It is simple in design and essentially mimics the behaviour of Apple's OS X Preference files, whereby strings can be associated with any parameters in a programme. It allows a user's setup to be recalled each time the patch is opened, without them having to modify the code actively. This is crucial in allowing the patches to be used within the Max/MSP Runtime environment.

Text-based development

As far as possible, any variable code in a patch is contained in text files, accessed using the object 'Coll'. This is exemplified in my construction of the performance patch for the composition *Speckle*, as detailed in the previous chapter. Some features of the 'Coll' object have been superseded by the comprehensive set of dictionary-based objects in Max/MSP version 6, although there have been no changes to the functionality of 'Coll' and my code has hence been unaffected.

SPATIALISATION CODE

Because of the lack of viable commercially available spatialisation tools (the majority being designed for use in cinematic sound and therefore using incompatible speaker layouts) a large amount of time over the course of my PhD was invested in research and development of tools for composing in 8-channels.

Below I have listed a few examples of tools that were developed.

- **Multichannel VSTs**: Four parallel stereo VST effect processors. 8-channel inputs

are jumbled before the processes to decouple the stereo inputs and the outputs are also either jumbled or subjected to further spatialisation to decouple processed pairs.

- **Keyboard spatializer**: An 8-channel panner controlled by a MIDI keyboard, allowing dynamic distribution of stereo source material.
- **Multi sample player**: A rudimentary random sample player, capable of up to 24 simultaneous playback streams, with the number of streams controlled by a single fader, enabling gestural control over the playback-density. The 24 playback streams are treated as 3 behavioural groups of 8, with each group having the capability of being assigned similar characteristics such as transposition range. This patch was used extensively in *Pent-up*.
- **8ch rhythmic machine**: A tempo-driven random sample player.
- **Sample accurate player**: Similar in principle to some of the tools above but with code that has greater refinement and the ability to trigger samples with sample-level accuracy. This patch was used extensively in *Tangle*.

The tools developed for sample-triggering require sound materials to be edited prior to their use in the patches. As such, the patches do not have the ability to split lengthy sections of audio into smaller segments, but instead provide a file/folder dropper.

MISCELLANEOUS CODE

Orbisms

The patch Orbisms is designed to produce fast melodic patterns as found in *The Orb's Adventures Beyond the Ultraworld* (The Orb 1991). For convenience, the final output of the patch is MIDI data since its ubiquity makes it easy to interface with most music software, allowing the user to generate sound in, for example, a prebuilt synthesiser or sampler.

The image below demonstrates basic operational information.

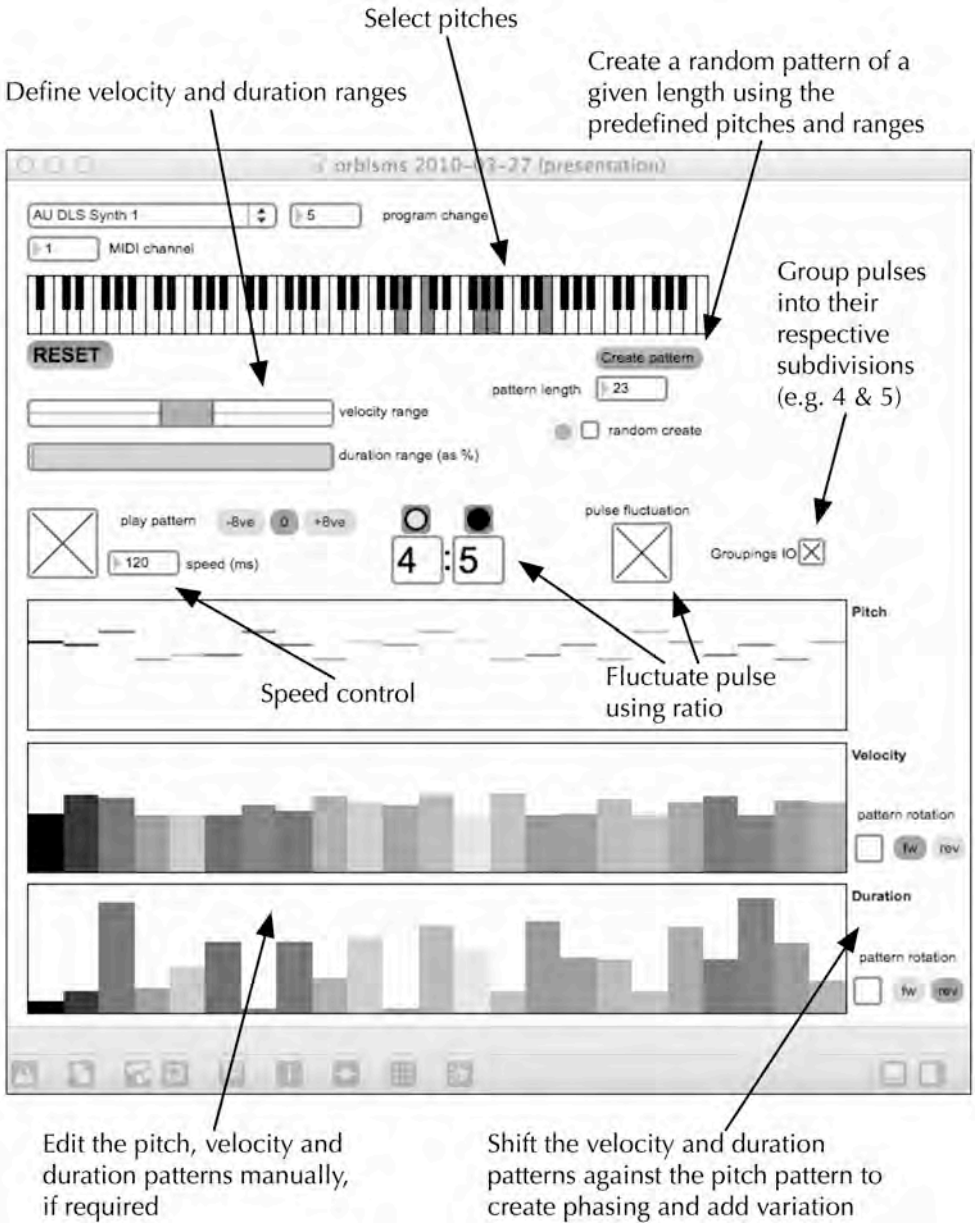


Figure 3 – Orbisms operational information

The patch was used extensively in *Crunchy* (the 2nd movement of *Sweet No.1*) to generate the synthesised materials beginning at around 4:00, which are also heard in near-isolation from 5:45.

iPhone control

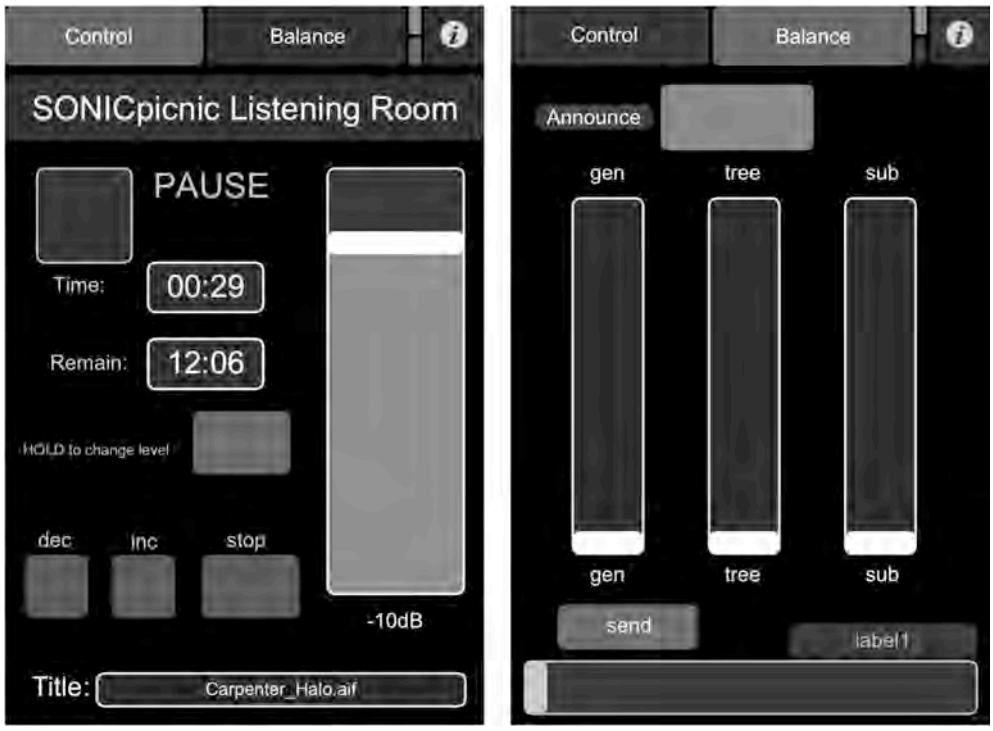


Figure 4 – iPhone diffusion control using TouchOSC

With some smaller diffusion systems on which I have worked it was considered inconvenient to place the desk at its ideal position in the centre of the room. As a solution, I used the iOS application TouchOSC (currently available for Apple's iPhone) to develop a touchscreen based controller, which sends Open Sound Control data over a local Wi-Fi network. The most thorough development work undertaken in this respect was for a 25-channel sound installation as part of local organisation SOUNDkitchen's *SONICpicnic* event in July 2011 (see the image above). The development of the controller was necessary in this situation, since I was in a position of having to engineer two stages whilst control the balance of material in the Immersive Listening Room (the

space which housed the installation). Also, in this case, the system running the installation was located in a difficult-to-reach part of the building.

Features of this controller were:

- Information regarding playback of the current file (e.g. name, time-elapsed, time-remaining).
- The ability to move between playback files and also pause the installation (using a slow fade).
- Safety switch – it is not possible to change any parameters without first holding another button. This was implemented to avoid the risk of inadvertently altering levels or stopping playback.

TouchOSC has an indicator to show network activity to and from the computer, which is helpful for verifying that the network traffic is flowing. On occasions when I have used a device where this feature is not present, I manually incorporate visual loop-back to verify that data is transmitting as expected.

14-bit random MIDI control

To introduce subtle inflection to commercially available processor plugins, hosted within standard DAWs (such as Nuendo), I built a basic interpolating random value MIDI controller. This offers the user the ability both to add automatic variation to a parameter and control multiple parameters simultaneously (up to 32). The decision to incorporate 14-bit controllers was based on my experience of the restrictions discovered when trying to achieve smooth transitions using the 128 steps available in

the standard 7-bit MIDI protocol. Unfortunately, 14-bit controllers are still unsupported by the majority of DAWs and their role is being superseded by OSC, which offers yet greater resolution.

Amongst its features include the ability to:

- set the range of the output using slider.
- switch between 7-bit (128 values) and 14-bit (16384 values, using standard coarse and fine pairs) MIDI controller output.
- quickly generate a value for use with a DAW's MIDI-learn feature.

APPENDICES

APPENDIX 1: PROGRAMME NOTES

Flux (panoramic)

A large amount of the source material for this composition was collected from an expansive field in Yorkshire, North England. “panoramic” refers to the form, since the piece surveys a sonic (and physical) landscape whilst “flux” refers to the continuous blending of material.

Mutable Musings

mu(tABLE/sINGS) … mutable musings … Thoughts, ideas, sounds, sources. Often subject to change (perhaps).

Pent-up

Five pitches. Nowhere to go.

Halo

Halo is: shimmering luminescence; a digital artefact; a spectre.

Composed in the electroacoustic studios at the University of Birmingham. The composer would like to offer posthumous thanks to the performers Adelaide Hall and Fela Sowande.

Sweet No.1

I – Grumpy

II – Crunchy

III – Pumpy

Saccharin music: music for chewing; music for toothache?

Three dance movements based on popular contemporary styles: the Grump; the Crunch; the Pump.

Tangle

Knotted and confused, tearing to escape.

Tangle was commissioned for BEAST through the University of Birmingham Circles of influence campaign, with funds provided by anonymous donor.

APPENDIX 2: PERFORMANCE INFORMATION

Please see the table below for information regarding performances of the pieces.

Flux (panoramic)

ICMC 2006, New Orleans, November 2006; *Sonic Voyages*, Bristol, November 2005; *real-time/non real-time*, Basel, June 2005; *Aix-en-Musique*, Aix en Provence, June 2005; *Resounding*, Birmingham, March 2005

Mutable Musings

Voyages Sonores, Birmingham, March 2006

Pent-up

Sonic Voyages, Bristol, April 2010; *NACHTSTROM XXXIX*, Basel, December 2008; *MANTIS Festival*, Manchester, November 2008; *ICMC 2008*, Belfast; *The Late Music Festival*, York, June 2008; Birmingham; *25 Years of BEAST*, Birmingham, January 2008; *Klangfest*, Birmingham, May 2007

Halo

Fierce Festival, Birmingham, April 2012; *SuperSonic Festival*, Birmingham, October 2011; Leicester, March 2009

Sweet No.1

Sonic Fingerprints, Birmingham, January 2010; *Travels in Time and Space*, Birmingham, May 2009

Crunchy (from Sweet No.1)

Bristol, June 2012; Edinburgh, November 2011; *Radio UCON*, Den Haag, November 2010

Tangle

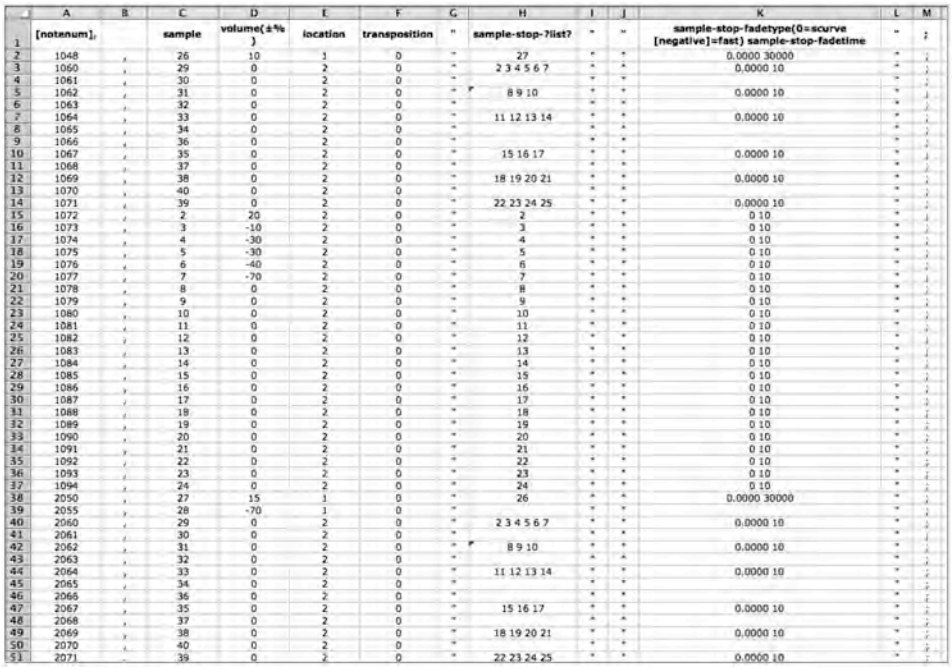
ICMC 2011, Huddersfield, August 2011; *Sonic Voyages: Intersections*, Bristol, May 2011; *States of Play*, Birmingham, October 2010; *Inventionen 2010*, Berlin, July 2010

Speckle

Simon Limbrick: Percussion and mixed media, Birmingham, February 2011; *Simon Limbrick: Percussion and mixed media,* Norwich, January 2011

APPENDIX 3: SPECKLE SPREADSHEET EXAMPLE

Here is an example of a spreadsheet used in the composition of Speckle. This method of cell-based editing is convenient for viewing the parameters in relative clarity, whereas the raw text-files are visually confusing.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	[notenum],		sample	volume(±%)	location	transposition	"	sample-stop-?list?	"	"	sample-stop-fadetype(0=scurve [negative]=fast) sample-stop-fadetime	"	;
2	1048	,	26	10	1	0	"	27	"	"	0.0000 30000	"	;
3	1060	,	29	0	2	0	"	2 3 4 5 6 7	"	"	0.0000 10	"	;
4	1061	,	30	0	2	0	"		"	"		"	;
5	1062	,	31	0	2	0	"	8 9 10	"	"	0.0000 10	"	;
6	1063	,	32	0	2	0	"		"	"		"	;
7	1064	,	33	0	2	0	"	11 12 13 14	"	"	0.0000 10	"	;
8	1065	,	34	0	2	0	"		"	"		"	;
9	1066	,	36	0	2	0	"		"	"		"	;
10	1067	,	35	0	2	0	"	15 16 17	"	"	0.0000 10	"	;
11	1068	,	37	0	2	0	"		"	"		"	;
12	1069	,	38	0	2	0	"	18 19 20 21	"	"	0.0000 10	"	;
13	1070	,	40	0	2	0	"		"	"		"	;
14	1071	,	39	0	2	0	"	22 23 24 25	"	"	0.0000 10	"	;
15	1072	,	2	20	2	0	"	2	"	"	0 10	"	;
16	1073	,	3	-10	2	0	"	3	"	"	0 10	"	;
17	1074	,	4	-30	2	0	"	4	"	"	0 10	"	;
18	1075	,	5	-30	2	0	"	5	"	"	0 10	"	;
19	1076	,	6	-40	2	0	"	6	"	"	0 10	"	;
20	1077	,	7	-70	2	0	"	7	"	"	0 10	"	;
21	1078	,	8	0	2	0	"	8	"	"	0 10	"	;
22	1079	,	9	0	2	0	"	9	"	"	0 10	"	;
23	1080	,	10	0	2	0	"	10	"	"	0 10	"	;
24	1081	,	11	0	2	0	"	11	"	"	0 10	"	;
25	1082	,	12	0	2	0	"	12	"	"	0 10	"	;
26	1083	,	13	0	2	0	"	13	"	"	0 10	"	;
27	1084	,	14	0	2	0	"	14	"	"	0 10	"	;
28	1085	,	15	0	2	0	"	15	"	"	0 10	"	;
29	1086	,	16	0	2	0	"	16	"	"	0 10	"	;
30	1087	,	17	0	2	0	"	17	"	"	0 10	"	;
31	1088	,	18	0	2	0	"	18	"	"	0 10	"	;
32	1089	,	19	0	2	0	"	19	"	"	0 10	"	;
33	1090	,	20	0	2	0	"	20	"	"	0 10	"	;
34	1091	,	21	0	2	0	"	21	"	"	0 10	"	;
35	1092	,	22	0	2	0	"	22	"	"	0 10	"	;
36	1093	,	23	0	2	0	"	23	"	"	0 10	"	;
37	1094	,	24	0	2	0	"	24	"	"	0 10	"	;
38	2050	,	27	15	1	0	"	26	"	"	0.0000 30000	"	;
39	2055	,	28	-70	1	0	"		"	"		"	;
40	2060	,	29	0	2	0	"	2 3 4 5 6 7	"	"	0.0000 10	"	;
41	2061	,	30	0	2	0	"		"	"		"	;
42	2062	,	31	0	2	0	"	8 9 10	"	"	0.0000 10	"	;
43	2063	,	32	0	2	0	"		"	"		"	;
44	2064	,	33	0	2	0	"	11 12 13 14	"	"	0.0000 10	"	;
45	2065	,	34	0	2	0	"		"	"		"	;
46	2066	,	36	0	2	0	"		"	"		"	;
47	2067	,	35	0	2	0	"	15 16 17	"	"	0.0000 10	"	;
48	2068	,	37	0	2	0	"		"	"		"	;
49	2069	,	38	0	2	0	"	18 19 20 21	"	"	0.0000 10	"	;
50	2070	,	40	0	2	0	"		"	"		"	;
51	2071	,	39	0	2	0	"	22 23 24 25	"	"	0.0000 10	"	;

Figure 5 – Spreadsheet for Coll data in *Speckle*

Syntactically, 'Coll' data is simple, requiring a comma following the index and a semicolon at the end of a line. The resulting list of data can be unpacked as required using a mixture of 'Unpack' and 'Zl' objects. Note that for lists to be treated as single entities (for forwarding as required) they must be enclosed in "", else the values will be interpreted separately.

It must be noted that the Speckle software was written using Max/MSP version 5.

Version 6 includes a series of dictionary objects, which have the potential to supersede much of the ‘Coll’ object’s functionality.

APPENDIX 4: DIAGRAMS OF 8-CHANNEL SURROUND ARRAYS

The two commonly used 8-channel formats are as follows:

"BEAST 8"[6]

This arrangement is formed of 4 stereo pairs moving front to back around the listener, as shown in the diagram below.

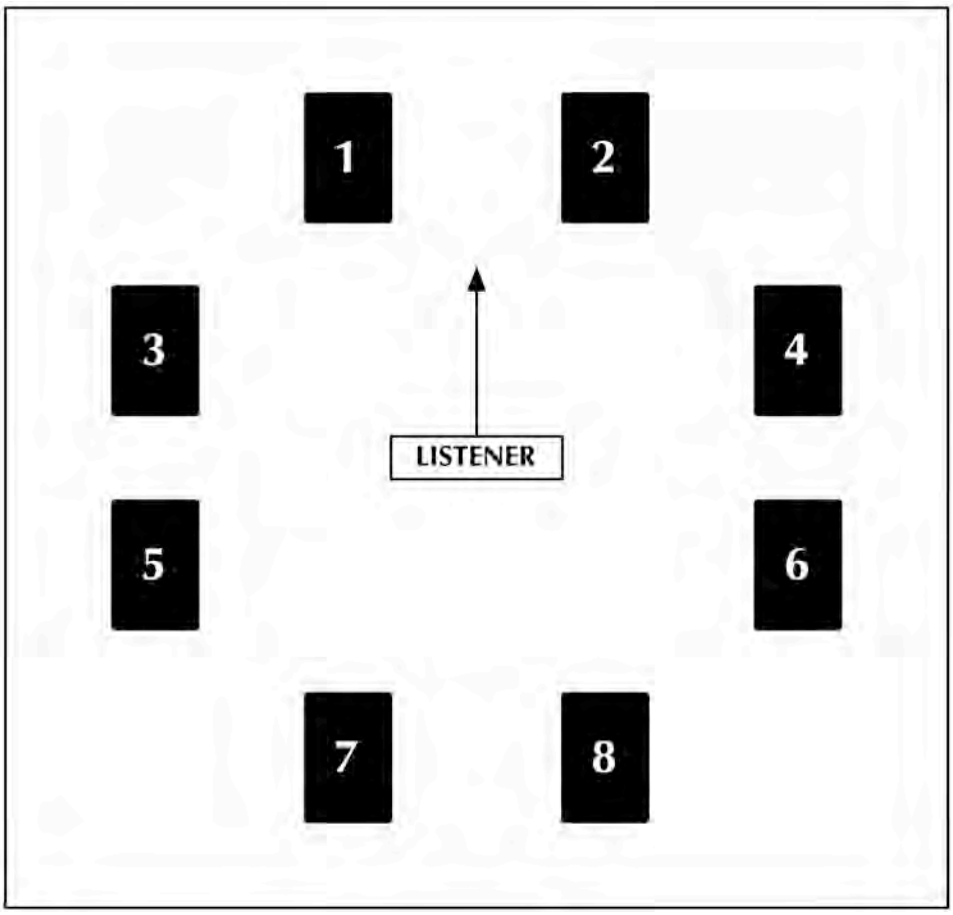


Figure 6 – The "BEAST 8" 8-channel configuration

[6] Also referred to as the "French 8", although there is no official name for the array.

“Double-diamond"

The double-diamond consists of two diamonds offset by 45°, as shown below. Crucially, this configuration results in a loudspeaker positioned front-centre and rear-centre about the listener.

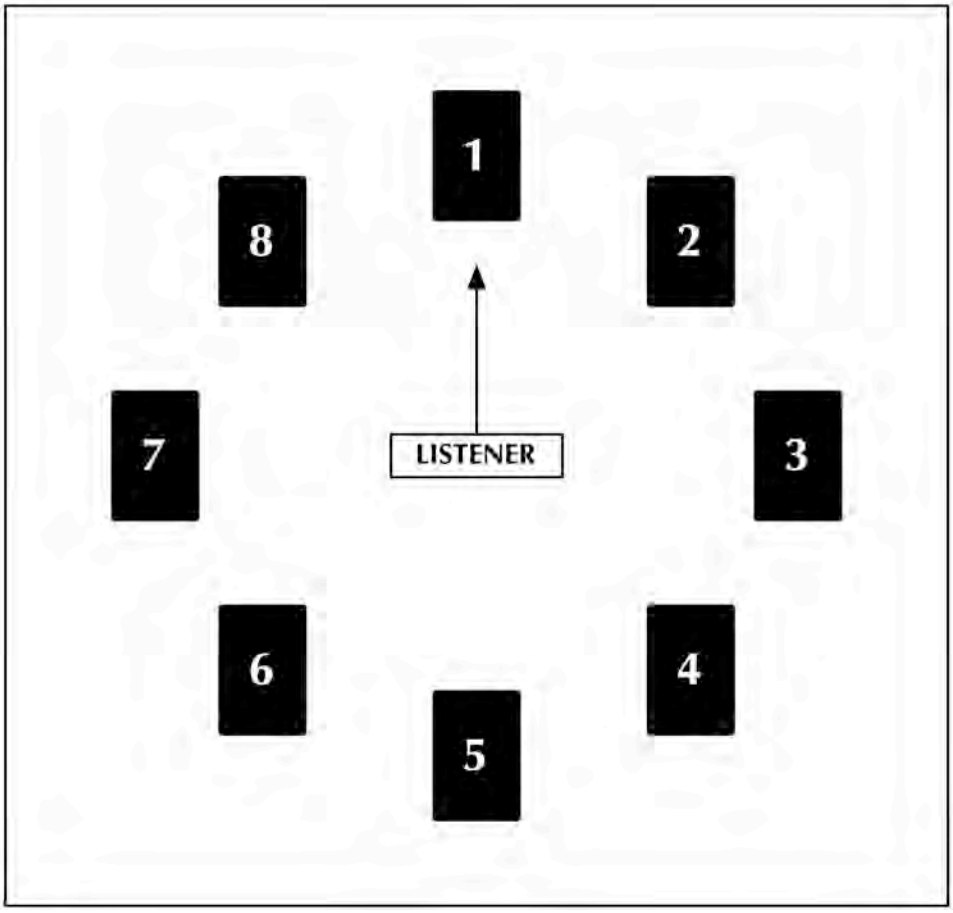


Figure 7 – The “double-diamond” 8-channel configuration

The channel numbering is not fixed for either of these formats, although the examples above show common channel-to-loudspeaker assignments.

APPENDIX 5: STEREO RENDERING OF MULTICHANNEL WORKS

This topic is discussed in terms of its aesthetic bearing earlier in the commentary, so I will concentrate in this appendix on the technicalities of creating a stereophonic rendering of a multichannel composition.

When one has composed a piece in more than two channels the question arises about how the music can be distributed to people who are unable to monitor using the correct multichannel array. With 8-channel loudspeaker arrays still being largely unavailable outside of academic circles it becomes necessary to render a stereo down-mix of the piece. An alternative is to render a 5.1 down-mix, although it is more likely for an individual to have a pair of high-quality stereo loudspeakers than an entire 5.1 system adhering to the same quality.

Up until the final stages of my studies, all stereo renders were achieved by collapsing the stereo pairs of the 8-channel array to a single stereo output, with the widths of the pairs varied in an attempt to emulate the spatial focus that a listener might perceive in the centre position (i.e. channels 5+6 are widest whilst 1+2 are narrower to mimic them being ±22.5° around the array's centre-line).

This can be represented visually as follows:

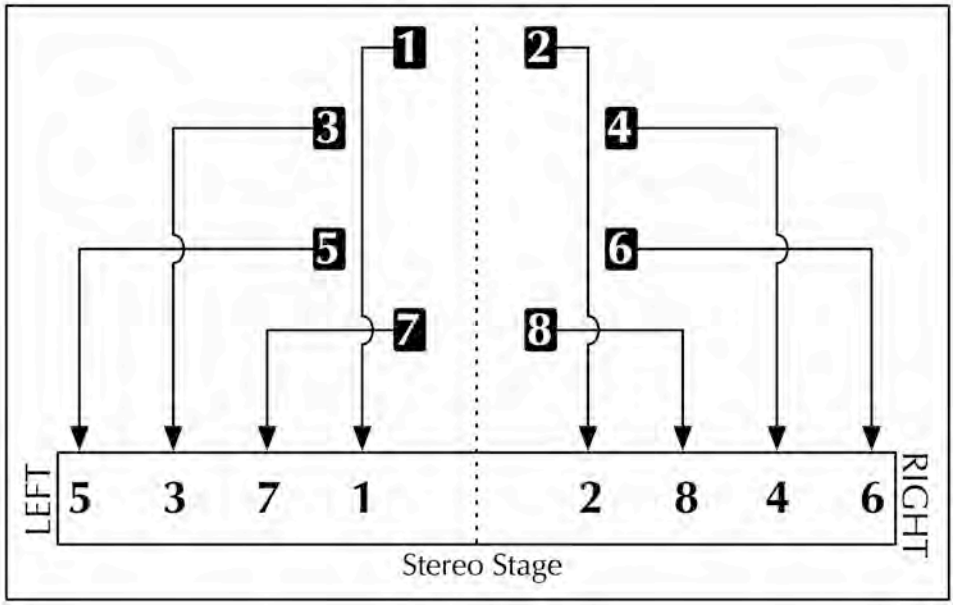


Figure 8 – Visual representation of stereo reduction

Whilst this technique provides a reasonable impression of the piece it is not perfect and has the ability to affect low frequency reproduction to a detrimental degree due to destructive phase interference when the channels combine.

During the process of this write-up, Rui Penha released a series of tools titled *Spatium* as part of his research into ambisonic distance encoding (Penha 2008). Amongst a number of other functions, the tool *spatium.ambi* allows the user to encode discrete channels from an 8-channel file into a 3rd-order ambisonic horizontal field (specifying each channel's position on the circle). The distance encoding abilities of the software, whilst interesting, were not directly applicable in this instance as each of the channels from the 8-channel array were effectively positioned on the perimeter of the circle;

likewise, the software also encodes 1st-order vertical information, which was not necessary. I ultimately used the software to create two additional versions of the 8-channel works: one for stereophonic loudspeaker playback (to replace my previous stereo reductions) and one for binaural listening on headphones. The latter is slightly compromised due to the uneven frequency response of MIT's HRTF (head-related transfer function) impulse responses, although it provides a truer rendering of the compositions' spatial trajectories.

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